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Monitoring thinned sugar pines in the Highway 62 Scenic Corridor, Rogue River-Siskiyou National Forest

Establishment Report

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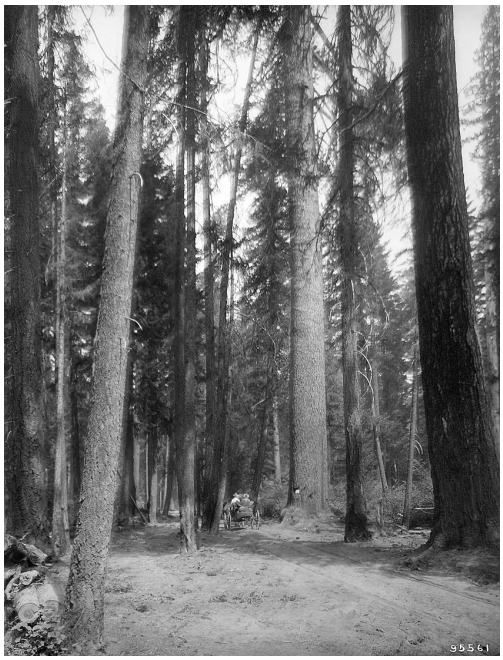
Background

The corridor along Oregon State Highway 62 between Prospect and Union Creek is a scenic, forested entry to the High Cascades recreation areas and Crater Lake National Park that has been enjoyed by travelers for generations. An important component of the view in the corridor is the large conifers, including ponderosa and sugar pines, Douglas-firs and incense cedars, some more than six feet in diameter. The corridor is designated as a Special Interest Area (SIA) in the Rogue River National Forest Land Management Plan. The objective of management in this SIA is to preserve the forest in a substantially natural condition, including retention of the large trees and preservation of a natural appearance.



Mortality of large sugar and ponderosa pines in the corridor has been ongoing for many years. In 1966 the Mammoth Pine was killed by mountain pine beetles (*Dendroctonus ponderosae*). In 1978 personnel from Forest Service Region Six Forest Pest Management visited the area. They observed mortality in the large pines due to bark beetle activity and recommended thinning to reduce stand density around the trees. In 1994 and 1995 the Southwest Oregon Forest Insect and Disease Technical Center conducted an intensive survey of the corridor to assess conifer mortality and stand conditions (Goheen et al 1997). The survey showed that between 1990 and 1995, 8.5 percent of sugar pines greater than 50 inches in diameter at breast height (dbh) and 10 percent of sugar pines greater than 60 inches dbh had died as a result of bark beetle infestation; an average mortality rate of approximately 2 percent per year. This compares with the mortality rate of 0.1 percent per year that is considered average background bark beetle-caused mortality among pines in stands where density is regulated by fire (personal communication, D. Bridgwater). Although there were several years of below-average precipitation during that time, stand densities measured during the survey were high enough to favor elevated levels of bark beetle activity irrespective of precipitation level. Research has shown pines to be at risk of bark beetle attack when basal areas are greater than 180 square feet per acre on good sites in Southwest Oregon. Stand densities measured in the corridor survey were at least 200 square feet per acre on 77 percent of plots with pines and at least 400 square feet per acre on 13 percent of plots with pines (Goheen et al 1997). Given the high stand densities, high rate of mortality and continued bark beetle activity, the number of large pines will continue to decline without management intervention.

To maintain a population of large sugar pines in the corridor, the district decided to reduce the density of competing vegetation around a selected number (Figure 1). In 2005, ninety large sugar pines were chosen for treatment by district personnel. Selection of the trees was based on ease of access from existing skid trails and roads (personal communication, R. Stuart). All trees within 50 feet of the selected sugar pine's bole and less than 29 inches in diameter at the stump (approximately equal to 24 inches diameter at breast height) were cut (personal communication, J. Lehman).

The objective of our monitoring project is to determine whether this treatment will be associated with an increase in growth and/or reduced mortality of the sugar pines due to bark beetles.

Methods

Twenty treated trees (map, Figures 2 and 3) were selected by randomly generating numbers between one and ninety using the Microsoft Excel Random Number Generator. Twenty control trees (map, Figures 2 and 3) were selected in areas of the corridor that district staff believe are likely to remain undisturbed by silvicultural activities for the next twenty years (personal communication, J.Lehman). Control trees were selected that appeared similar in size and age to the treated trees and were free of major visible defects such as fire scars, decay or broken tops. Yellow metal "Please Protect" signs and numbered aluminum tags were nailed to each tree on the side facing away from the highway (numbered tags not necessarily at dbh). At each treated and control tree the following data were collected: GPS coordinates using map datum WGS 84 (Table 2), status (all currently live), dbh, total height (with a laser rangefinder), live crown ratio (LCR), radial growth during the past five and ten years, any visible damaging agents (DAM) and their severity (SEV), and the number of trees less than 5.0 inches dbh by species in a hundredth acre plot around the tree. At treated trees the current (post-treatment) basal area per acre was measured with a variable radius plot using a Spiegel Relaskop and a basal area factor (BAF) of 40. Basal area per acre removed by the treatment was estimated from the stumps using the Relaskop. Maximum plot radius for borderline stumps was determined by measuring the distance to the center of the stump and multiplying by the plot radius factor for 40 BAF (Dilworth 1977). At the control trees current basal area per acre was measured using the same method as at the treated trees. The center of the variable radius and hundredth acre plots were five feet from center of the north side of both treated and control trees.

The data was analyzed using Microsoft Excel for Windows 2000 and SPSS version 10.1. The difference in means between treated and control trees were tested using the independent samples T-test after examining box-plots to determine whether the data from each variable were normally distributed. Differences in means with *P-value* less than or equal to 0.05 were considered statistically significant. The pre-treatment basal area around treated trees was calculated by adding the basal area removed to the current basal area.

Figure 1. Example of untreated (A) and

treated (B) sugar pines

Baseline Conditions

There were no statistically significant differences in dbh, height, live crown ratio or radial growth between the treated and control trees, or in the number of small trees per acre (less than 5 inches dbh) that surrounded them (Table 1). There were significant differences in the basal area per acre of trees surrounding the treated and control trees both before and after the treatments took place. The basal area per acre of trees surrounding the treated trees before treatment was significantly higher than the basal area per acre around the control trees. After the treatments took place the basal area per acre around the treated trees was significantly lower than the basal area per acre around the control trees.

Table 1. Summary of treated and control tree data

		Treated trees (n = 20)	Control trees (n = 20)	*P*-value (2-tailed) for equality of means
Dbh (inches)	Mean	52.7	50.0	
	SD	8.0	14.7	0.49
Height (feet)	Mean	180	173	0.28
	SD	12	26	
Live crown ratio (percent)	Mean	47	44	0.40
	SD	9	11	
Pre-treatment basal area (ft^2 per acre)[1]	Mean	274	196	0.010
	SD	92	89	
Post treatment basal area (ft^2 per acre)	Mean	114	196	0.002
	SD	63	89	
Radial growth past 5 years (20th inch)	Mean	6	7	0.57
	SD	1	2	
Radial growth past 10 years (20th inch)	Mean	13	13	0.69
	SD	2	3	
Number of trees per acre <5” diameter	Mean	320	530	0.10
	SD	332	446	

1. Pre-treatment basal area of control trees is the same as post-treatment basal area

Symptoms of white pine blister rust (dead tops and dead or flagged branches) were visible in sixty-five percent of the treated trees and 55 percent of the control trees. Other damaging agents observed on the trees were *Phellinus pini* conks, fire scars, broken tops, and bole wounds probably caused by previous logging. If significant portions of a tree are affected, these agents, particularly blister rust, can reduce tree vigor, predisposing them to attack by bark beetles.

Recommendations for Future Data Collection

Future monitoring and analysis will be conducted by SWOFIDSC personnel. The next data collection is planned for 2011. After that, we recommend that the pines be monitored at five year intervals for at least 15 more years (until 2026). At each visit we suggest the following data be collected: tree condition (live or dead), if dead, cause of mortality if known, dbh, five-year radial growth, basal area per acre of trees 5 inches dbh or greater surrounding the pines, number of trees per acre less than five inches dbh surrounding the pines and new damaging agents. At the end of 15 years, height and live crown ratio should also be remeasured.

Acknowledgments

We would like to thank Judd Lehman, Victor Rooney and Roy Stuart, High Cascades Ranger District, Rogue River-Siskiyou National Forest for providing background information and assistance in locating appropriate places for selecting the control trees.

References

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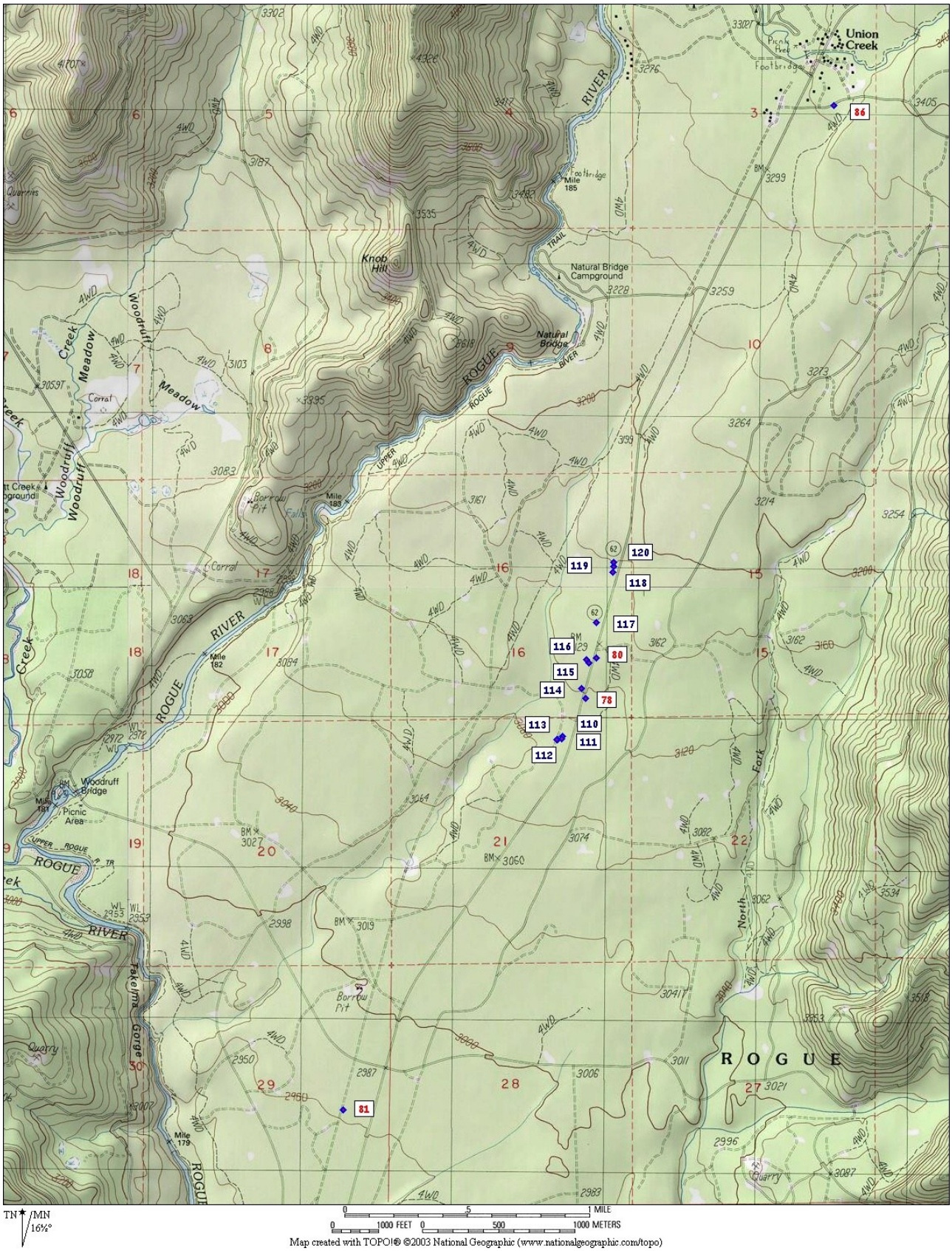

Figure 2. Location of treated (red) and control (blue) trees selected for monitoring

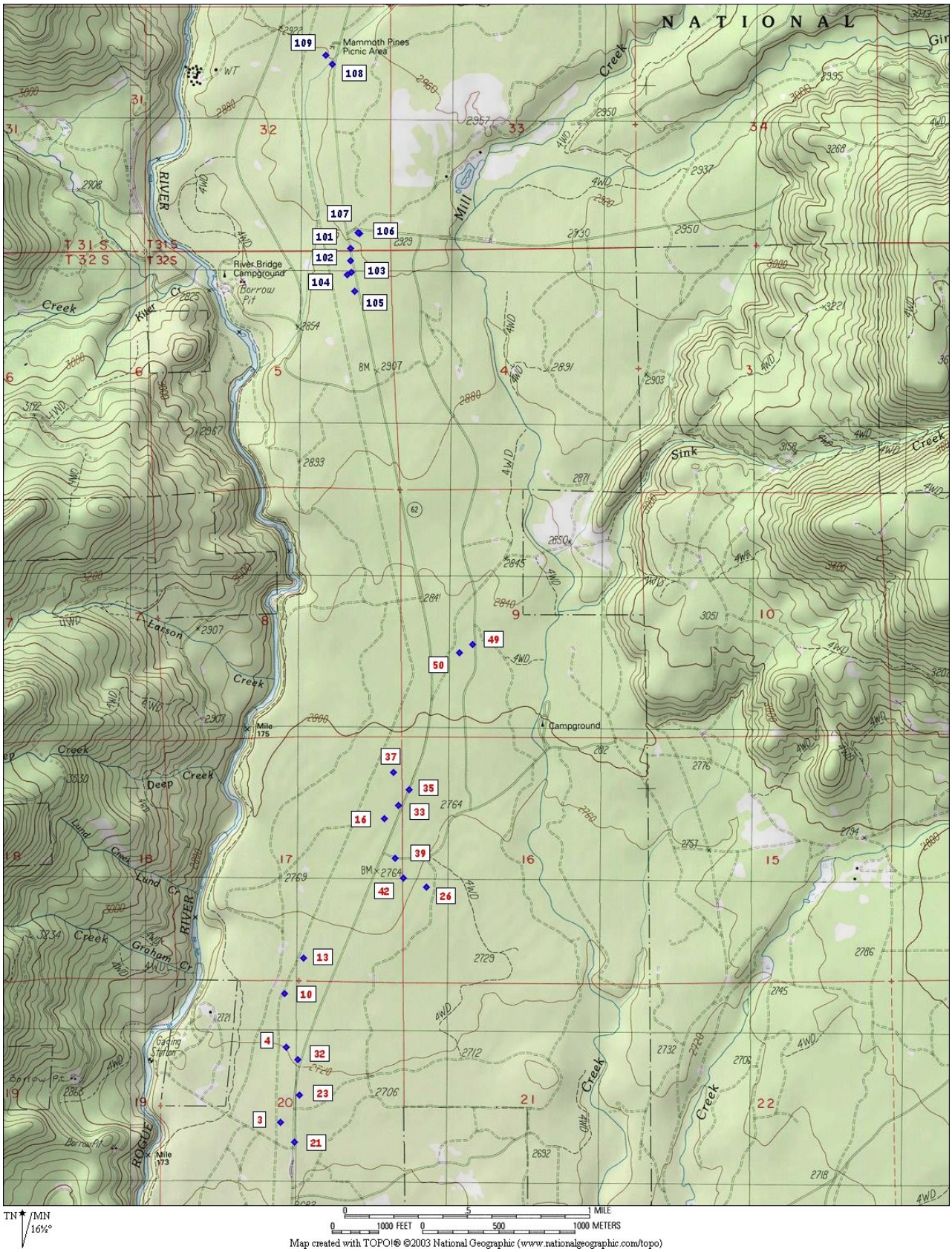

Figure 3. Location of treated (red) and control (blue) trees selected for monitoring

Table 2. Latitude and longitude coordinates, treated and control trees

TYPE	TREE NUMBER	LATITUDE	LONGITUDE
Treated trees	3	42.77158462	-122.48899807
	4	42.77604380	-122.48852072
	10	42.77923663	-122.48866011
	13	42.78134887	-122.48710795
	16	42.78962617	-122.48054710
	21	42.77040839	-122.48781430
	23	42.77321482	-122.48741934
	26	42.78553002	-122.47718671
	32	42.77531818	-122.48753761
	33	42.79039102	-122.47946139
	35	42.79134337	-122.47855145
	37	42.79233905	-122.47984260
	39	42.78725082	-122.47969734
	42	42.78606746	-122.47902922
	49	42.79992015	-122.47346213
	50	42.79946015	-122.47453753
	78	42.86821724	-122.46414573
	80	42.87060080	-122.46322020
	81	42.84376153	-122.48373751
	86	42.90342593	-122.44403570
Control trees	101	42.82347053	-122.48327508
	102	42.82271231	-122.48333660
	103	42.82204326	-122.48325471
	104	42.82187965	-122.48357087
	105	42.82093249	-122.48295690
	106	42.82434586	-122.48256580
	107	42.82440168	-122.48273176
	108	42.83438964	-122.48477728
	109	42.83491896	-122.48528497
	110	42.86592999	-122.46596703
	111	42.86580384	-122.46606803
	112	42.86573092	-122.46638370
	113	42.86576805	-122.46643885
	114	42.86880858	-122.46444823
	115	42.87029805	-122.46381691
	116	42.87050449	-122.46401791
	117	42.87272276	-122.46324006
	118	42.87568795	-122.46193659
	119	42.87605616	-122.46185118
	120	42.87627015	-122.46184959

APPENDIX

TREATED TREE DATA 2008 (continued next page)

TREE	STAT	DBH	HGT	LCR	BASAL AREA PRE-TREATMENT[1]	BASAL AREA REMOVED					
		inches	feet	percent	ft^2 per ac	ft^2 per ac					
						PSME	CADE	PILA	ABCO	TSHE	TOTAL
3	L	53.9	175	50	80	40					40
4	L	68.8	192	55	280	80			120		200
10	L	61.2	172	45	320	40			200		240
13	L	46.6	160	60	160	40				80	120
16	L	45.5	172	45	200	80					80
21	L	47.2	193	40	360	240					240
23	L	48.2	157	35	480	120	40	80			240
26	L	45.7	156	40	200	160					160
32	L	51.8	186	45	320	80			40		120
33	L	54.0	204	50	280	40	40				80
35	L	51.4	175	40	320	120					120
37	L	58.9	179	60	160	80	40				120
39	L	49.8	188	40	240	40	40				80
42	L	57.8	177	65	280	200					200
49	L	53.5	182	35	400	240	40				280
50	L	54.1	186	35	280	40			120		160
78	L	58.1	194	60	360	40	160		40		240
80	L	67.6	180	35	200	80			40		120
81	L	37.9	185	50	280	200	40				240
86	L	41.1	180	45	280	80			40		120

1. Pre-treatment (TRT) basal area (calculated) = basal area removed + current basal area

TREATED TREE DATA 2008 (continued next page)

TREE	CURRENT BASAL AREA ft^2 per acre						RADIAL GROWTH 20th inches			DAM[1]	SEV	DAM	SEV	DAM	SEV
	PSME	CADE	PILA	ABCO	PIPO	TOTAL	Past 5 years	Previous 5 years	Past 10 years						
3	40					40	7	8	15	92	2	47	2	36	1
4	80					80	5	7	12	36	1				
10	40		40			80	7	6	13	92	2	96	0	36	3
13			40			40	7	7	14						
16	40	40			40	120	7	6	13	36	2				
21		40	40		40	120	7	6	13						
23	40	80	120			240	7	7	14	97	0	36	3		
26			40			40	8	9	17	36	1				
32	80	40	40	40		200	8	7	15	36	3	97	0		
33		40	80		80	200	8	7	15						
35	40	40			120	200	7	8	15	47	2				
37	40					40	7	4	11	36	1				
39	40	80	40			160	5	8	13	90	2	47	2	92	2
42		80				80	6	5	11						
49	40	40	40			120	4	4	8	36	3	96	1		
50			120			120	5	6	11	36	3	97	0		
78	80		40			120	5	7	12						
80	80					80	5	5	10	36	3	97	0		
81	40					40	7	8	15	36	1				
86	120				40	160	7	6	13	36	3				

1. Damage and severity rated using codes from USDI (1997)

TREATED TREE DATA 2008

TREE	NUMBER OF TREES ≤ 5.0" DBH IN 100TH ACRE PLOTS										
	TSHE	ARME	CADE	PSME	COCO	CACH	ABCO	SALIX	TABR	TOTAL	NOTES
3	1	1	1		1					4	blister rust very minor
4						1				1	
10					1	5		1		7	
13					1					1	
16						3				3	
21		1	4		2					7	
23			1			5				6	
26										0	
32				2	1	1	6		1	11	
33										0	
35						2				2	
37			5	1		2				8	
39										0	
42										0	
49						1				1	
50					3		2			5	
78					1					1	double top
80						1				1	
81			1		1	3			1	6	
86										0	double top, 1 fork dead

CONTROL TREE DATA 2008 (continued next page)

TREE	STAT	DBH	HGT	LCR	CURRENT BASAL AREA							
		inches	feet	percent	feet^2 per acre							
					PSME	CADE	PILA	ABCO	TSHE	PIPO	PIMO	TOTAL
101	L	66.0	194	45	80							80
102	L	48.8	172	40	80	40	40					160
103	L	67.9	206	35	200							200
104	L	48.5	195	25	200							200
105	L	46.9	168	40	160			40				200
106	L	48.0	178	30	200			40	40			280
107	L	41.1	161	45	80				80			160
108	L	69.4	210	40	120					40		160
109	L	36.0	165	25	240	40		40				360
110	L	73.6	198	60	80	40	40					160
111	L	32.2	140	35	120	40	40					200
112	L	50.5	144	50	80		80					160
113	L	54.5	168	50	120							120
114	L	65.4	208	50	120							120
115	L	41.1	179	45	280			120				400
116	L	39.0	177	35	240			40				280
117	L	23.7	116	55	200			120				320
118	L	61.7	175	50	80	40					40	160
119	L	60.5	170	65				120				120
120	L	25.7	128	55	40			40				80

CONTROL TREE DATA 2008 (continued next page)

TREE	RADIAL GROWTH 20th inch Past 5 years	Previous 5 years	Past 10 years	DAM[1]	SEV	DAM	SEV	NOTES
101	6	8	14					dead branch at 108 ft
102	9	11	20	36	1			
103	8	9	17	47	1	36	1	
104	6	5	11	36	1			
105	5	5	10	36	3	97	0	
106	6	6	12	92	2			
107	9	8	17					
108	4	5	9	92	2	36	1	
109	8	8	16	36	1			
110	7	6	13					
111	4	3	7	36	1			
112	6	5	11	97	1	36	3	
113	7	7	14	36	1			
114	6	6	12	36	1			
115	6	5	11					
116	6	6	12	92	2			
117	6	8	14					
118	7	6	13	36	3	97	0	
119	9	9	18					
120	9	7	16					

1. Damage and severity rated using codes from USDI (1997)

CONTROL TREE DATA 2008

TREE	NUMBER OF TREES ≤ 5.0" DBH IN 100TH ACRE PLOTS									
	TSHE	ARME	CADE	PSME	COCO	CACH	ABCO	PILA	TABR	TOTAL
101		1	1	8	2	2		1		15
102	1			3		2		1		7
103										0
104	3									3
105				1	2	9	1			13
106				1						1
107	2			4		1	2			9
108						1				1
109				1						1
110						1	1			2
111				2			4			6
112			1				2			3
113										0
114						7	5			12
115						3	5			8
116							5			5
117						7	1		1	9
118						1		1	1	3
119						3			1	4
120						2	2			4